B is formed by stator poles **1510***b* and **1510***e* and phase C is formed by stator poles **1510***c* and **1510***g*. Similarly, the coil windings on the stator poles **1510***g*-**1510***l* on the inside of the stator **1510** result in three phases, where phase A is formed by stator poles **1510***g* and **1510***j*, phase B is formed by stator poles **1510***h* and **1510***k* and phase C is formed by stator poles **1510***i* and **1510***l*.

[0237] In the illustrated embodiment, the windings around each of the stator poles **1510***a*-**1510***f* have the same polarity as the windings around each of the stator poles **1510***g*-**1510***l* respectively. In other words, the polarity of coil windings around stator pole **1510***a* is the same as the polarity of coil windings around stator pole **1510***g*, the polarity of coil windings around stator pole **1510***b* is the same as the polarity of coil windings around stator pole **1510***h*, the polarity of coil windings around stator pole **1510***c* is the same as the polarity of coil windings around stator pole **1510***i*, the polarity of coil windings around stator pole **1510***d* is the same as the polarity of coil windings around stator pole **1510***j*, the polarity of coil windings around stator poles **1510***e* is the same as the polarity of coil windings around stator pole **1510***k* and the polarity of coil windings around stator pole **1510***f* is the same as the polarity of coil windings around stator pole **1510***l*.

[0238] As well, in SRM **1500**, adjacent phases formed by coil windings around stator poles have opposite winding polarity. For example, phase A windings around stator poles **1510***a* and **1510***g* have a polarity opposite to phase B windings around stator poles **1510***b* and **1510***h* respectively. Likewise, phase B windings around stator poles **1510***b* and **1510***h* have a polarity opposite to phase C windings around stator poles **1510***c* and **1510***i* respectively, phase C windings around stator poles **1510***c* and **1510***i* have a polarity opposite to phase A windings around stator poles **1510***d* and **1510***j* respectively, phase A windings around stator poles **1510***d* and **1510***j* have a polarity opposite to phase B windings around stator poles **1510***e* and **1510***k* respectively, phase B windings around stator poles **1510***e* and **1510***k* have a polarity opposite to phase C windings around stator poles **1510***f* and **1510***l* respectively, and phase C windings around stator poles **1510***f* and **1510***l* have a polarity opposite to phase A windings around stator poles **1510***a* and **1510***g* respectively.

[0239] In the embodiment illustrated in FIG. **15**, since both interior and exterior machines have three phases, two excitation conditions arise that require sharing of stator back-iron. The first excitation condition occurs when the adjacent phases of interior and exterior machines, such as, for example, exterior phase A and interior phase B, are tuned on simultaneously. At the junctions of adjacent exterior and interior phases, the same winding polarities result in opposite fluxes.

[0240] The second excitation condition occurs when the same phases of interior and exterior machines, such as, for example, exterior phase A and interior phase A, are tuned on simultaneously. By having the interior machine winding polarity identical to the exterior machine winding polarity, when the same phase of the exterior and interior machines is excited, fluxes with opposite directions result in the stator yoke.

[0241] Reference is next made to FIGS. **16**A and **16**B, which illustrate isolated exterior and interior machines according to example embodiments. FIG. **16**A illustrates the symmetrical half of a cross-sectional view of an isolated exterior SRM **1600** according to an example embodiment. FIG. **16**B illustrates the symmetrical half of a cross-sectional view of an isolated interior SRM **1650** according to an example embodiment.

[0242] Isolated exterior SRM **1600** comprises an exterior rotor **1605** and a stator **1610** disposed inside the exterior rotor **1605**. Isolated interior SRM **1650** comprises the stator **1610** and an interior rotor **1615** disposed inside the stator **1610**. Exterior rotor **1605** and interior rotor **1615** are segmented, and stator **1610** comprises coil wound stator poles on the outer and inner edges of the stator **1610**.

[0243] Reference is next made to FIGS. **17**A-**17**F, which illustrate magnetic flux density plots of different configurations of SRMs according to different embodiments. FIG. **17**A illustrates a magnetic flux density plot **1700** of an isolated exterior SRM, such as an isolated exterior SRM **1600** of FIG. **16**A, according to an example embodiment. FIG. **17**B illustrates a magnetic flux density plot **1710** of an exterior machine of a segmented double rotor SRM, such as a central stator wound SRM **1500** of FIG. **15**A, according to an example embodiment. The magnetic flux density plot **1710** of FIG. **17**B results when adjacent phases (for example, exterior phase A and interior phase B or C, but not interior phase A) are excited. FIG. **17**C illustrates a magnetic flux density plot **1720** of an exterior machine of a segmented double rotor SRM, such as a central stator wound SRM **1500** of FIG. **15**A, according to an example embodiment. The magnetic flux density plot **1720** of FIG. **17**C results when same phases (for example, exterior phase A and interior phase A) are excited.

[0244] FIG. **17**D illustrates a magnetic flux density plot **1730** of an isolated interior SRM, such as an isolated interior SRM **1650** of FIG. **16**B, according to an example embodiment. FIG. **17**E illustrates a magnetic flux density plot **1740** of an interior machine of a segmented double rotor SRM, such as a central stator wound SRM **1500** of FIG. **15**A, according to an example embodiment. The magnetic flux density plot **1740** of FIG. **17**E results when adjacent phases (for example, exterior phase A and interior phase B or C, but not interior phase A) are excited. FIG. **17**F illustrates a magnetic flux density plot **1750** of an interior machine of a segmented double rotor SRM, such as a central stator wound SRM **1500** of FIG. **15**A, according to an example embodiment. The magnetic flux density plot **1750** of FIG. **17**F results when same phases (for example, exterior phase A and interior phase A) are excited.

[0245] As illustrated, away from the stator back-iron, the magnetic flux density plots **1700**, **1710** and **1720** of FIGS. **17**A, **17**B and **17**C are almost identical to each other and magnetic flux density plots **1730**, **1740** and **1750** of FIGS. **17**D, **17**E and **17**F are almost identical to each other. Since the magnetic flux density plots are almost identical between isolated and shared conditions, the stator back-iron flux path sharing has a negligible impact on machine operation when adjacent phases or same phases are excited. Furthermore, on the stator back-iron section where magnetic flux coupling does occur, flux density does not increase at any location. In fact, some positions even see a reduction in flux density. This is achieved by winding polarity design, as illustrated in SRM **1500** of FIG. **15**, and is critical in ensuring that stator back-iron sharing does not lead to iron loss increase.

[0246] Due to the winding polarity design, as illustrated in SRM **1500** of FIG. **15**, when adjacent phases are excited, as illustrated in FIGS. **17**B and **17**E, the flux directions of the